give a lucid explanation of the principles governing the various processes, which may be understood by readers not necessarily acquainted with photographic manipulation.

The opening chapters introduce the elementary ideas of the nature of colour and the undulatory theory of light. Following these is a chapter on the Lippmann process, this being the only direct process having a purely physical origin.

The fourth chapter deals with the principles of colour vision, showing how the colour curves of red, green and blue sensitiveness are employed in deciding the screens used in the three-colour photographic process; two processes of this type, founded by Ives and Joly respectively, being then fully explained.

The work is brought up to date by descriptions of Wood's diffraction grating process, and later improvements on the Joly process. A chapter is also devoted to three-colour photomechanical processes, and another to the method developed by Sanger Shepherd and others of producing lantern slides in three colours.

Lecons nouvelles sur les applications géométriques du calcul différentiel. Par W. de Fannenberg, Professeur à la Faculté des Sciences de l'Université de Bordeaux. Pp. 192. (Paris: A. Hermann, 1899.)

THE geometrical applications of the differential calculus, which are usually given in English treatises on the calculus, are mostly confined to plane curves. In these lessons, on the contrary, the author begins by assuming a knowledge of elementary analytical geometry of three dimensions, and proceeds at once to deal with subjects which occur in the latter part of an English text-book on solid geometry, in chapters on the general theory of curves and surfaces.

Thus we have sections on the descriptive properties of tortuous curves and curved surfaces, followed by sections on the metrical properties of tortuous curves, of ruled surfaces, and of surfaces in general.

The author's treatment of his subject is exceedingly clear and elegant, and there is considerable freshness of method. We may notice, in particular, the early employment of the six co-ordinates of a line; the use of the system of moving axes formed by the tangent, the principal normal and the binormal at a point on a curve; the systematic application of Gaussian curvilinear co-ordinates in developing the properties of the several classes of curves that may be traced on a surface.

In fact, a student will find here in small compass a pleasant introduction to some of the most powerful methods of modern analysis as applied to geometry, and if he proceeds afterwards to the "Leçons sur la théorie générale des surfaces," by Darboux, his study of that great classic will have been much facilitated.

Elementary Illustrations of the Differential and Integral Calculus. By Augustus De Morgan. New Edition. Pp. viii+142. (Chicago: The Open Court Publishing Company. London: Kegan Paul and Co., Ltd., 1899.)

IT is nearly seventy years since De Morgan first published this tractate in the Library of Useful Knowledge. It was afterwards bound up with his large treatise on the differential and integral calculus, but the very inferior typography detracts much from the pleasure of perusing it there. In the present issue we have a very attractive reprint. Although there has been in recent years almost a superabundance of elementary treatises on the calculus, some of them not lacking excellent illustrations of the fundamental principles and processes of the subject, it may still be said that De Morgan's effort at popularisation remains the greatest of its kind, and far above all others in the philosophic spirit which animates it.

LETTER TO THE EDITOR.

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A Surface-Tension Experiment.

IF an unbroken vertical jet of falling water is allowed to impinge normally on a smooth circular disc, whose diameter is rather greater than that of the jet, then a phenomenon, illustrated by the accompanying photographs, is observed. These are one-ninth natural size.

A disc about 7 mm. in diameter was supported on the upper end of a knitting-pin, which was held vertically in a clamp.

A jet of water proceeding from a tube of 6 mm. internal diameter was directed downwards, so as to strike the disc centrally.

If the initial velocity of the jet is high, then an umbrella-shaped sheet is formed, which breaks up into a shower of drops at its margin. On diminishing the rate of outflow, the broken

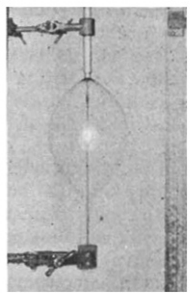

FIG. 1.
4000 c.c. per min.

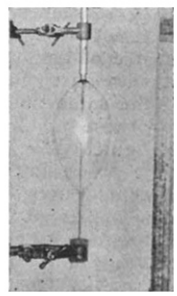

FIG. 2.
3000 c.c. per min.

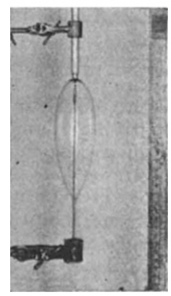

FIG. 3.
2100 c.c. per min.

edge of the sheet gathers itself together and closes inwards until it reaches the upright supporting the disc, thus forming a completely closed pear-shaped surface (Fig. 1). The surface-tension of the falling sheet thus drags in the water radially, for if it were in separate drops these would describe parabolic paths.

On further restricting the water supply there is, in general, a tendency for the surface to elongate and at the same time to contract laterally, thus becoming more spindle-shaped (Figs. 2 and 3). In this condition the figure is remarkably steady and well defined.

With a still slower stream of water (Fig. 4), the spindle reaches a certain critical length at which it first begins to

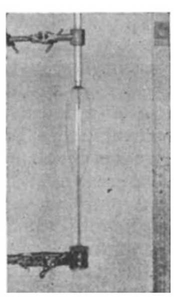

FIG. 4.
1600 c.c. per min.

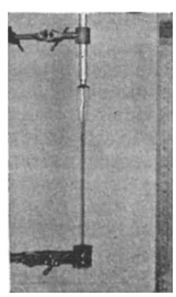

FIG. 5.
1000 c.c. per min.

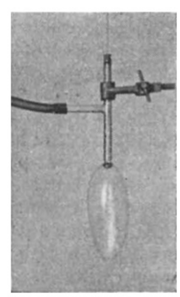

FIG. 6.

oscillate vertically and to pulsate, and then a sudden constriction occurs causing the division of the spindle into two bubbles, one of which rushes down and the other up the vertical support.

The latter bubble persists as a small conical figure immediately beneath the disc (Fig. 5).

Since there is an almost instantaneous transition from Fig. 4 to Fig. 5, it was not found possible to photograph any of the intervening conditions.